CLAIMS

1. A multi-channel densitometer for measuring optical density of a sample at a plurality of sensor positions, said densitometer comprising:

a plurality of sensors, disposed relative to said sample such that each said sensor receives light impinging first upon said sample, and thence from said sample to said sensor, and has an output characteristic of the light intensity incident on said sensor; and

a controller circuit having electrical connection to each said sensor, said controller circuit providing power to said sensors, and receiving said outputs from said sensors;

whereby said controller circuit collects signals characteristic of the optical density of said sample at a plurality of said sensor positions.

2. A multi-channel densitometer as set forth in Claim 1, wherein:

each said sensor is a light-to-frequency converter, having a frequency output with frequency characteristic of the light intensity incident on said light-to-frequency converter; and

said controller circuit has electrical connection to each said light-to-frequency converter, said controller circuit providing power to said light-to-frequency converters, and receiving said frequency outputs from said light-to-frequency converters; and further including

digital processing means within said controller circuit adapted to measure at least one of the period and the frequency of said frequency outputs;

whereby said frequency outputs have a period and a frequency, which are characteristic of the optical density of said sample at respective said sensor positions.

3. A multi-channel densitometer as set forth in Claim 2, wherein:

at least one said light-to-frequency converter is programmable in real-time in at least one of the parameters of light sensitivity and frequency divide-by ratio; and

said controller circuit outputs a programmable parameter code into said at least one light-to-frequency converter such that the period of said frequency outputs is within a predetermined period range; and further including:

computing means to compute optical density values of said sample, at said sensor positions;

whereby said frequency outputs have a period and a frequency that, in combination with said programmable parameter code, are characteristic of the optical density of said sample at respective said sensor positions.

4. A multi-channel densitometer as set forth in Claim 1, and further including an output of said sample optical density values to at least one receiving device from the group consisting of host computers, networks, alphanumeric displays, graphic displays, digital storage devices, digital-to-analog converters, and means for adjusting subsequent sample processing.

5. A multi-channel densitometer as set forth in Claim 1, and further including means to compute at least one multi-channel function of optical density from the group of function types consisting of uniformity, net density, transfer efficiency, and color.

6. A multi-channel densitometer as set forth in Claim 5, and further including an output of at least one multi-channel function of optical density to at least one receiving device from the group consisting of host computers, networks, alphanumeric displays, graphic displays, digital storage devices, digital-to-analog converters, and means for adjusting subsequent sample processing.

7. A multi-channel densitometer as set forth in Claim 1, and further including, for at least one said sensor, a light emitter, emitting light impinging first upon said sample, and thence from said sample to said sensor, said emitter and said sensor forming an emitter-sensor pair.

8. A multi-channel densitometer as set forth in Claim 7, wherein at least one of said light emitters is a light emitting diode.

9. A multi-channel densitometer as set forth in Claim 7, wherein a plurality of said emitter-sensor pairs are of differing emitter color or peak wavelength, whereby areas of said sample of differing colors can be measured with high sensitivity using said light emitters of complementary colors to said respective areas, and whereby areas of the same color can be characterized in color by a plurality of measurements using said differently colored light emitters.

10. A multi-channel densitometer as set forth in Claim 1, and further including, for at least one said sensor, a plurality of light emitters of differing color or peak emission wavelength, selectively energized one at a time, illuminating substantially the same spot of said sample opposite said sensor, whereby areas of differing colors of said sample, in the same cross-track position, can be measured in turn with high sensitivity as said areas pass, by using said light emitters of complementary color to said respective areas.

11. A multi-channel densitometer as set forth in Claim 1, and further including, for at least one said sensor, a set of three light emitters of red, green, and blue color, successively energized one at a time, illuminating substantially the same spot of said sample opposite said sensor, whereby a set of three output values of said sensor characterizes the color of said sample.

12. A multi-channel densitometer for measuring optical density of a sample at a plurality of sensor positions, said densitometer comprising:

at least one independently locatable probe, each containing at least one sensor, and disposed relative to said sample such that each said sensor receives light impinging first upon said sample, and thence from said sample to said sensor, and has an output characteristic of the light intensity incident on said sensor; and

an independently locatable controller circuit having electrical connection to each said probe, said controller circuit providing power to said sensors, and receiving said outputs from said sensors;

whereby said controller circuit collects signals characteristic of the optical density of said sample at a plurality of said sensor positions.

13. A multi-channel densitometer as set forth in Claim 12, wherein:

each said sensor is a light-to-frequency converter, having a frequency output with frequency characteristic of the light intensity incident on said light-to-frequency converter; and

said controller circuit has electrical connection to each said light-to-frequency converter, said controller circuit providing power to said light-to-frequency converters, and receiving said frequency outputs from said light-to-frequency converters; and further including

digital processing means within said controller circuit adapted to measure at least one of the period and the frequency of said frequency outputs;

whereby said frequency outputs have a period and a frequency that are characteristic of the optical density of said sample at respective said sensor positions.

14. A multi-channel densitometer as set forth in Claim 12, and further including, on at least one said probe, a light emitter, emitting light impinging first upon said sample, and thence from said sample to said sensor, whereby said light emitter and said sensor remain in the same position, orientation, and alignment relative to each other when said at least one probe is relocated.

15. A multi-channel densitometer as set forth in Claim 14, wherein at least one channel is of the transmission type, having said light emitter and said sensor disposed on opposite sides of said sample, whereby a portion of the light emitted from said light emitter passes through said sample and impinges on said sensor.

16. A multi-channel densitometer as set forth in Claim 14, wherein at least one channel is of the reflection type, having said light emitter and said sensor disposed on the same side of said sample, whereby a portion of the light emitted from said light emitter is reflected from said sample and impinges on said sensor.

17. A multi-channel densitometer as set forth in Claim 12, wherein a plurality of said probes are of different length from each other, each having said light-to-frequency converter and a connector at opposite ends, whereby measurement is obtained at a distance from said connector according to the length of said probe.